

CLAIMS

1. A substrate processing vessel for processing therein a substrate with a processing fluid, comprising:

a vessel body;

a cover adapted to be separatably and hermetically joined to the vessel body to define a processing space together with the vessel body;

a plurality of substrate support rods incorporated into the vessel body; and

a driving device adapted to vertically move the substrate support rods between a first vertical position and a second vertical position;

wherein each of the substrate support rods has a head adapted to support a substrate from below the same, and a shank extending downward from the head,

the vessel body is provided with a plurality of vertical bores each having an open upper end opening into the processing space, and the shanks of the substrate support rods are vertically movably inserted in the bores, respectively,

the head of each substrate support rod is sized such that the head is unable to pass through the bore of the vessel body, and the heads of the substrate support rods are configured to close the open upper ends of the bores when the substrate support rods are held at the first vertical position.

2. The substrate processing vessel according to claim 1, wherein the head of each substrate support rod is provided with an elastic sealing member that is brought into contact with a part, around the open upper end of the bore, of the vessel body to prevent the processing fluid from flowing from the processing fluid into the bore when the substrate support rod is held at the first vertical position.

3. The substrate processing vessel according to claim 2, wherein an upper surface of the vessel body is provided with recesses adapted to receive the heads of the substrate support

rods held at the first vertical position, respectively, and the bores of the vessel body extend downward from the bottom surfaces of the recesses, respectively, and the elastic sealing members arranged so that they are brought into contact with the bottom surfaces of the recesses, respectively.

4. The substrate processing vessel according to claim 1, wherein the head of each of the substrate support rods has an outer circumference tapering downward, and an inner circumference of each of the bores adjacent to an upper end portion of each of the bores has a shape complementary to the tapered outer circumference of the head of each of the substrate support rods, whereby each of the outer circumferences and each of the inner circumferences are in close contact with each other to form a seal that prevents a processing fluid from flowing from the processing space to each of the bores when the substrate support rod is held at the first vertical position.

5. The substrate processing vessel according to claim 1 further comprising a plurality of substrate support members arranged on the vessel body to support the substrate from below the same,

wherein substrate support surfaces of the substrate support members are at a height higher than that of substrate support surfaces of the heads of the substrate support rods at the first vertical position, whereby the substrate is supported by the substrate support members without being supported by the substrate support rods when the substrate support rods are at the first vertical position.

6. The substrate processing vessel according to claim 1, wherein the driving device includes:

arms respectively connected to the shanks of the plurality of substrate support rods projecting downward from lower ends of the bores of the vessel body, the arm being arranged under a bottom surface of the vessel body; and

an actuator adapted to move the arms vertically.

7. The substrate processing vessel according to claim 6 further comprising bellows respectively surrounding the shanks of the plurality of substrate support rods projecting down from the lower ends of the bores of the vessel body,

wherein each of the bellows has an upper end hermetically connected to a part, around the lower end of the bore, of the vessel body, and a lower end hermetically connected to the arm.

8. The substrate processing vessel according to claim 6 further comprises an arm locking mechanism having a stopper adapted to separatably engage with the arm to lock the arm.

9. The substrate processing vessel according to claim 1 further comprising:

an actuator adapted to move the cover vertically; and

a cover locking mechanism having a stopper adapted to separatably engage with the cover or a member fixed to the cover to lock the cover.

10. The substrate processing vessel according to claim 1, wherein said vessel has a sealing part for preventing leakage of the processing fluid from the processing space, and a sealed space is defined on a side of the sealing part opposite to a processing-space side of the sealing part,

said substrate processing vessel further comprising a suction line connected to the sealed space, and a pressure gage placed in the suction line, whereby leakage of the processing fluid through the sealing part can be detected by measuring pressure in the sealed space by the pressure gage.

11. The substrate processing vessel according to claim 10, wherein the sealed space is the bore of the processing vessel receiving the shank of the substrate support rod.

12. The substrate processing vessel according to claim 10,

wherein a joint of the vessel body and the cover is sealed by a first sealing member and a second sealing member disposed on an outer side of the first sealing member, and the sealed space is a space defined by the first and the second sealing member.

13. The substrate processing vessel according to claim 10, an ozone process line provided with an ozone killer is connected to the suction line.

14, The substrate processing vessel according to claim 1, wherein the driving device includes a piston connected to the substrate support rods, a cylinder surrounding the piston, and a working fluid supply system adapted to supply a working fluid to the cylinder.

15. The substrate processing vessel according to claim 1 further comprising an actuator adapted to move the cover vertically, and springs pushing the substrate support rods upward;

wherein:

the cover is provided with a pressing member adapted to come into contact with the heads of the substrate support rods to depress the substrate support rods against resilience of the springs when the cover is lowered; and

the driving device includes the springs, the actuator and the pressing member.

16. The substrate processing vessel according to claim 1 further comprising a vessel locking mechanism adapted to force the vessel body and the cover to closely join together and prevent separation of the cover from the vessel body, when the cover contacts the vessel body.